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# Illinois Commerce Commission
# US EPA Clean Power Plan Policy Session

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# Overview

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- Four Building Blocks in US EPA Clean Power Plan
- Building Block #1 – Heat Rate Improvements
- Building Block #2 – 70% CCGT Capacity Factor
- Other Considerations
  - Heat Rate
  - Conversion to Natural Gas
  - Implication of Market Design
  - $CO_2$ Offsets
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    - Compliance – Rate-based vs. Mass Based
- Initial Recommendations



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# Dynegy Geographic and Fuel Diversity


| Coal Segment | IPH | Retail | Gas Segment | Development |
|---|---|---|---|---|
| • ~3,000 MWs of baseload capacity<br>• Environmentally compliant with current regulations<br>• Burns low sulfur Powder River Basin coal<br>• Low-cost fuel due to favorable long-term rail contracts | • ~4,000 MWs of baseload capacity<br>• Environmentally compliant with current regulations<br>• Burns low sulfur Powder River Basin coal | • Retail business serving ~15 TWh of load in Illinois<br>• Serves commercial and industrial customers and 335 municipal aggregation communities in both Ameren and ComEd service territories<br>• Retail headquarters located in Collinsville, IL | • ~6,000 MWs of total generating capacity<br>• ~4,400 MWs of combined cycle intermediate load capacity<br>• Environmentally-compliant with current regulations | • Exploring renewable energy alternatives at Morro Bay site<br>• Evaluating repowering at Oakland<br>• 80 MW uprate at Kendall |

**Today Dynegy operates a 13 GW portfolio with diverse generation complemented by an integrated retail portfolio**



Note: Net capacity shown based on winter capacity; (1) Net MW reflecting 80% interest in EEI, which owns Joppa Steam and MEPI Joppa 6B

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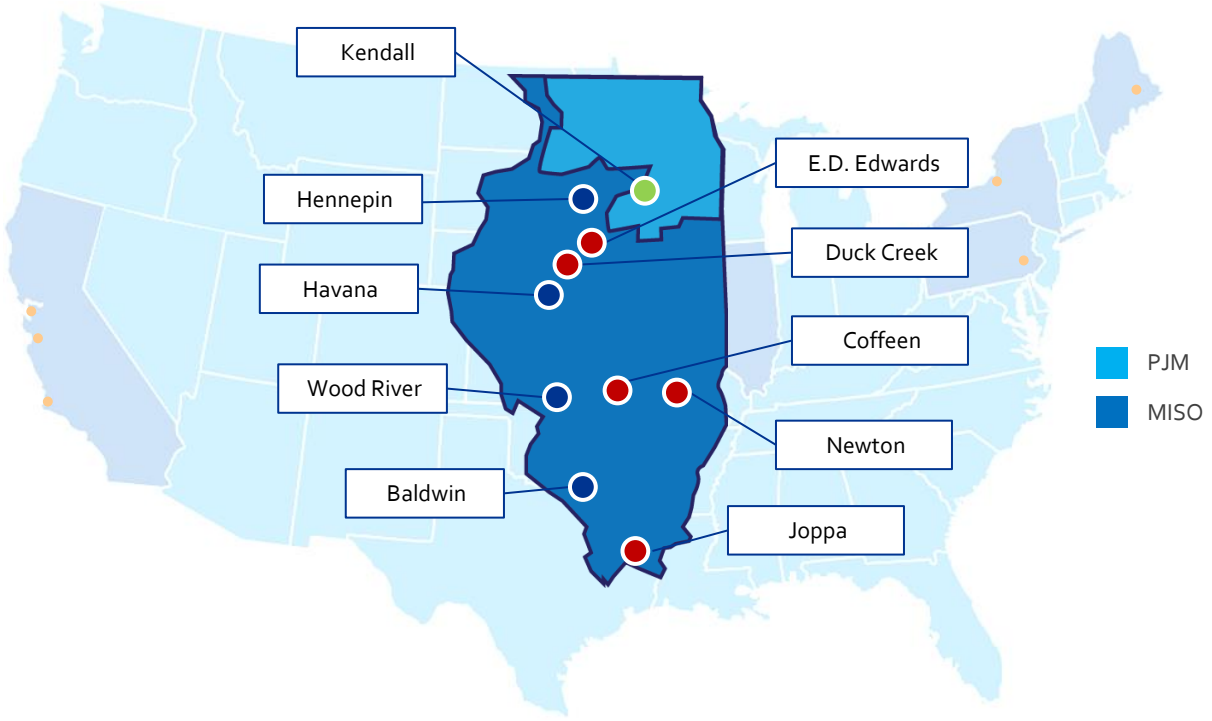
# Dynegy in Illinois




| Key Facts and Figures [1] | | |
|---|---|---|
| | **Illinois** | **Nationally** |
| **Employees** | 1,200 | 1,650 |
| **Operating and maintenance expenses** | $435 MM | $557 MM |
| **Capital expenses** | $279 MM | $321 MM |
| **Taxes paid** (property, sales and use) | $48 MM | $61 MM |
| **Annual retail volume** | 15 MM MWh | 15 MM MWh |

[1] All dollar amounts are for 2012 and include Ameren's expenditures as the previous owner of the AER facilities.



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# Overview of US EPA Building Blocks

## 1. Heat Rate Improvements

**6%** improvement in average heat rate at coal-fired steam generators by 2030

Best practices **4%**, low cost equipment upgrades **2%**

## 2. Coal-to-Gas Switching

**70%** capacity factor for existing natural gas combined cycle generation by 2030

## 3. Low Carbon Generation

Individualized state renewable generation targets based on existing state renewable portfolio standards

**5.8%** "at risk" nuclear capacity by state

## 4. Demand-side Efficiency

**1.5%** annual increase in demand-side energy efficiency

**States may rely on any, all or none of the above to achieve compliance**



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# Building Block #1 – Heat Rate Improvements

| Case Studies: In-Progress, Completed or Under Consideration | | Result |
|---|---|---|
| **Turbine Upgrade**<br>Replace High Pressure (HP), Intermediate Pressure (IP) and Low Pressure (LP) sections at fossil unit<br>Approximate capital cost: $30-40M | → | 1.5% Heat Rate **Improvement** |
| **Efficiency Project**<br>Advanced Gas Path (AGP) upgrade at CCGT<br>Approximate capital cost: $30M | → | 1.5% Heat Rate **Improvement** |
| **Installation of $SO_2$ Controls**<br>"Scrubber" installation at coal plant | → | **Degradation** of Heat Rate by 1.8% |

**Past improvements need to be reflected in the Clean Power Plan**
**Further improvements, where and when possible, will require significant investment**



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# Building Block #2 – 70% CCGT Capacity Factor

| | |
|---|---|
| **Natural Gas Infrastructure** | • Higher CCGT capacity factors will require significant gas infrastructure build-out; the restructured electricity markets will need to develop a product or cost recovery mechanism to support the build-out |
| **Balancing Renewables** | • CCGTs will effectively become base-loaded, which in conjunction with increased renewable penetration (building block #3) will allow little or no room for CCGT fleet to balance intermittent renewables |
| **Cost Impacts** | • Base-loading CCGT fleet will significantly increase CCGT maintenance costs |
| **Fossil Plant Efficiency** | • Heat rate (efficiency) of fossil plants is inversely correlated with loading and capacity factor (see illustration on following slide) |



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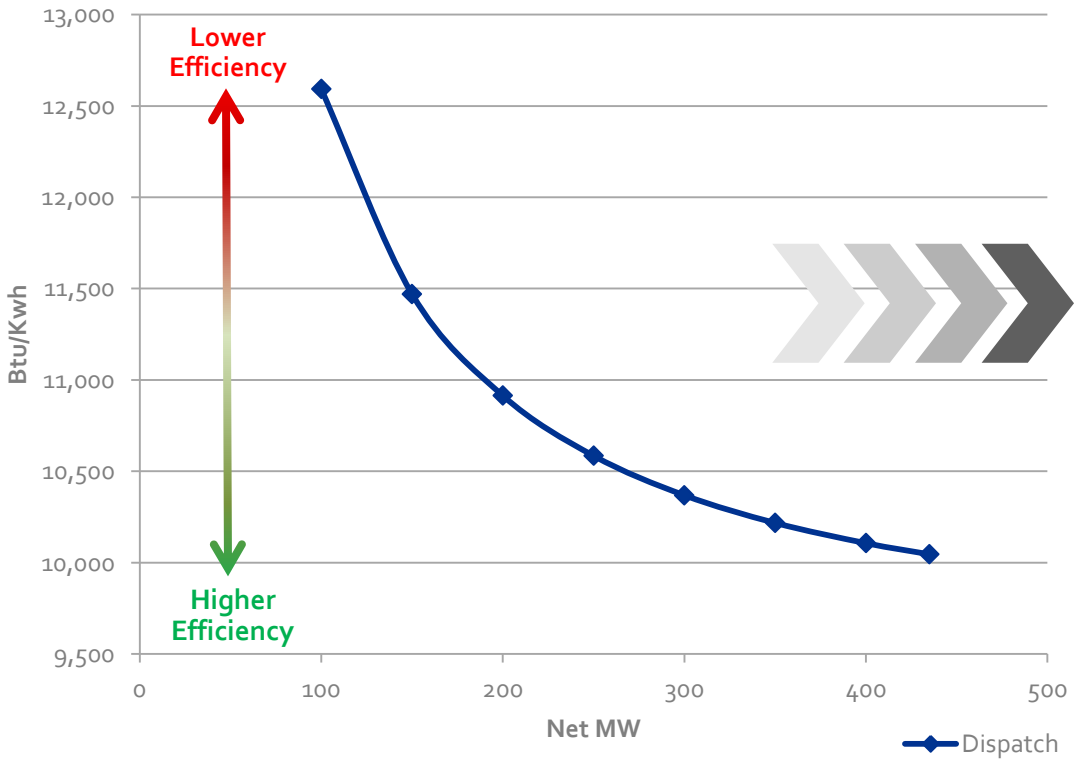
# Building Blocks 1 & 2: Efficiency vs. Operating Capacity Factors

## Typical Coal-Fired Generation Heat Rate




Coal and gas-fired plants operate more efficiently at higher operating levels

Lower operating levels degrade efficiency by up to 25%

**Building Block 2 will degrade coal plant efficiency, putting further pressure on Building Block 1**



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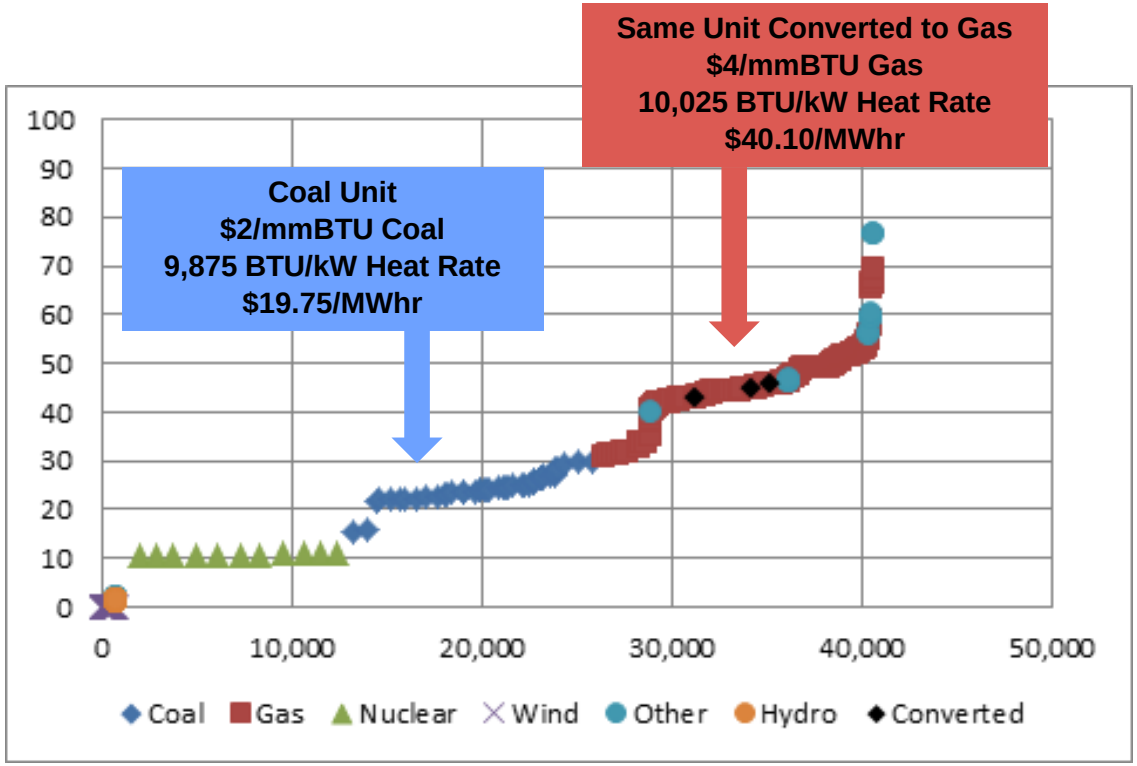
# Coal-to-Gas Conversion of Plants




Conversion requires a large capital investment at the plant, as well as investment in a natural gas delivery infrastructure

Typical coal plant efficiency is degraded 1.5% on natural gas

Dispatch costs increase significantly, even assuming inexpensive gas

**While conversion from coal to natural gas can be costly, leveraging existing sites through conversion will be less expensive than building new plants**



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# Market Design Considerations

## Plant in PJM Market

Last Auction Clearing Price $120/MW-Day

**= $22M / Year** Capacity Revenue for a 500 MW plant


## Plant in MISO Market

Last Auction Clearing Price $16.75/MW-Day

**= $3M / Year** Capacity Revenue for a 500 MW Plant

[ Only 14% of the revenue of a similar PJM-located plant ]

**MISO market design will need to be improved to stimulate required investment and ensure reliability**



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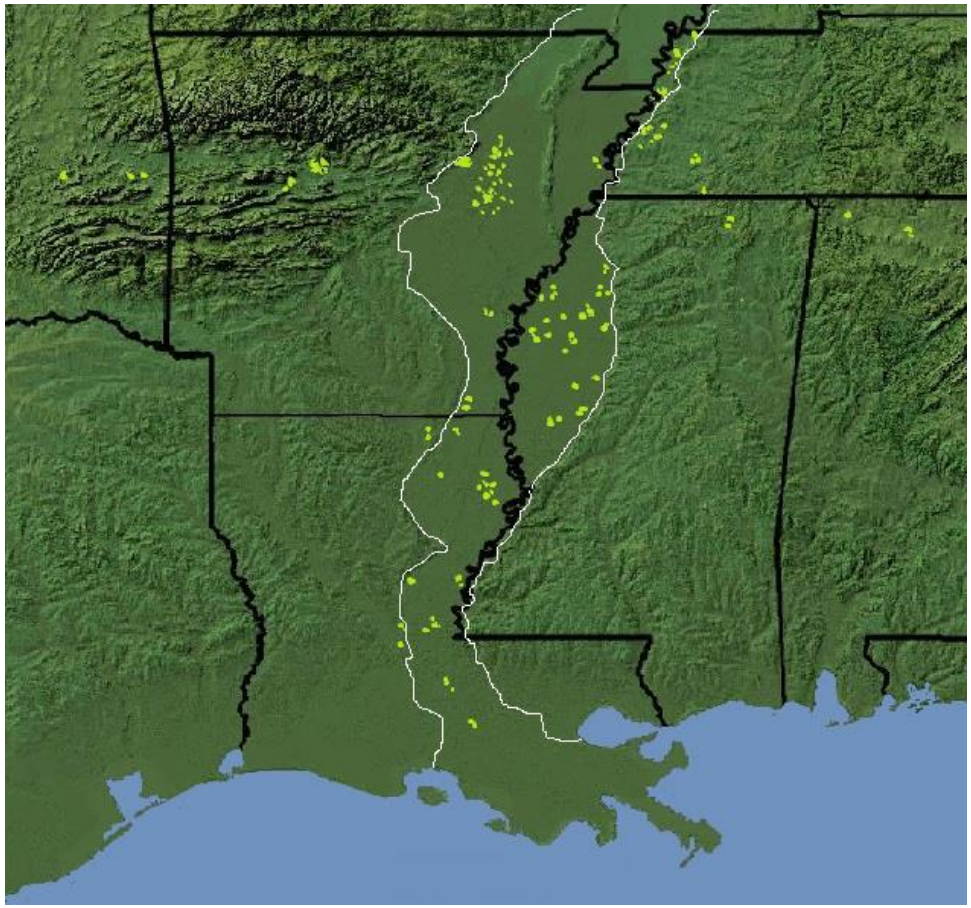
# Opportunities for $CO_2$ Reduction: Offsets



Dynegy has planted 9 million trees in 73 locations across 8 states in the Mississippi River Valley

This verified project offsets over 101,000 metric tons of $CO_2$ per year

At the time of planting, it was the largest private forestation project developed exclusively for reducing $CO_2$

This project offsets the same $CO_2$ as a 60 MW wind farm

**The Clean Power Plan and state compliance plans should include provisions for $CO_2$ offset programs**

Note: Assumes coal plant emits 1 metric ton per MWhr and wind farm at 20% annual capacity factor



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# Opportunities for $CO_2$ Reduction: Offsets

- Fly ash from coal combustion is recycled for beneficial re-use, including as a substitute for Portland cement in concrete
- In addition to safely re-using coal fly ash in lieu of landfilling, the re-use of fly ash reduces the amount of Portland cement produced
- The reduction of cement production directly offsets the amount of $CO_2$ generated by the cement manufacturing process

Dynegy is currently evaluating a fly ash re-use technology that has the potential to offset the $CO_2$ emissions equivalent to a 200 MW wind farm, providing not only the reduction in emissions but also eliminating the environmental impact associated with a wind farm of that size

**Beneficial re-use of fly ash has many benefits in addition to significantly reducing $CO_2$, including eliminating the need for further development of infrastructure or natural resources**



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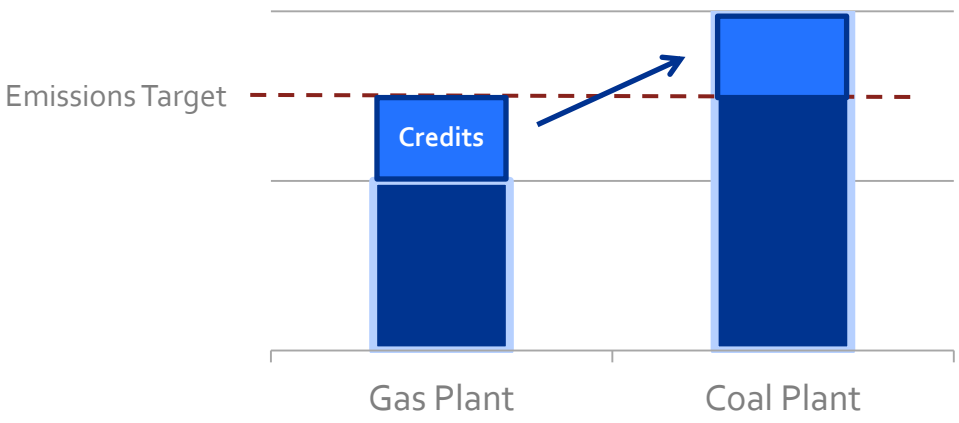
# Compliance

- There is no cost-effective, proven control technology that can reduce $CO_2$ emissions from fossil plants
- Achieving further heat rate and efficiency improvements will be challenging
- This will make compliance with a strict rate limit difficult to achieve




**Under a rate-based cap-and-trade program, affected sources that generate emissions below a target would generate credits**

**Affected sources that generate in excess of that target would acquire the credits to meet compliance**

"Affected sources" are fossil plants subject to 111(d)

**A rate-based or mass-based cap-and-trade program will most likely provide a lower-cost pathway to compliance than a strict rate limit**



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# Initial Recommendations

The market design in Southern/Central Illinois must be improved to incent the investments that both the US EPA and state will depend upon

The US EPA building blocks should recognize the practical limitations around heat rate improvements and the increased use of natural gas

$CO_2$ can be reduced through offset programs, which have numerous benefits including mitigating the cost of the Clean Power Plan on consumers

A mass-based cap-and-trade program will most likely provide the lowest-cost compliance pathway and least cost to consumers

**Over $2B has been invested in environmental upgrades at the Dynegy Illinois fleet with another $250M planned**



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